Space Weather Technical Forecast

Issued on Friday 27 September 2024 at 01:26 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of M-flares (R1-R2 Blackouts). Increasing chance of Active High energy electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with a M1.4 flare observed at 26/2312 UTC from a new region approaching the southeast limb. There are eleven sunspot regions visible, with previous AR3831 now rotated behind the west limb, however these are all relatively small and simple regions with only limited development. The largest remains AR3836 in the southeast, although it is magnetically simple. Two new regions are visible on the east limb.

There were no Earth-directed CMEs , however there are a number of filaments on the Earth-facing disc, which have the potential to disrupt and produce CMEs.

Solar Wind / Geomagnetic Activity: The fast wind from CH72/+ continued to ease, with solar wind speeds at ACE and DSCOVR easing from slightly elevated levels around 490 km/s to end the period at background levels around 360 km/s. Density eased from slightly above average to below average. Interplanetary Magnetic Field, Bt, was weak between 3-6nT. The north-south component, Bz, was weakly negative for much of the day, with a minimum -5nT. Only brief periods of weakly positive (northward) field occurred, mainly late in the day. Phi angle was mostly positive (away from the Sun). Geomagnetic activity was Unsettled to Active (Kp 3-4) until 26/1800 UTC, then Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at Background. High energy electron flux (greater than 2MeV) observed by GOES16 increased to predominantly Moderate levels, although did briefly reach High levels, peaking at 1113 pppc at 26/1505 UTC. The associated 24-hour fluence was below the Active threshold, but with a rising trend. The 27/0000 UTC observation was 3.63e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with an ongoing chance of further isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, with the previous anticipated CME arrival likely having missed. Solar winds are expected to remain at background levels until a possible weak high speed stream arrives either late day 2 or day 3 (28-29 Sep), from

---

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

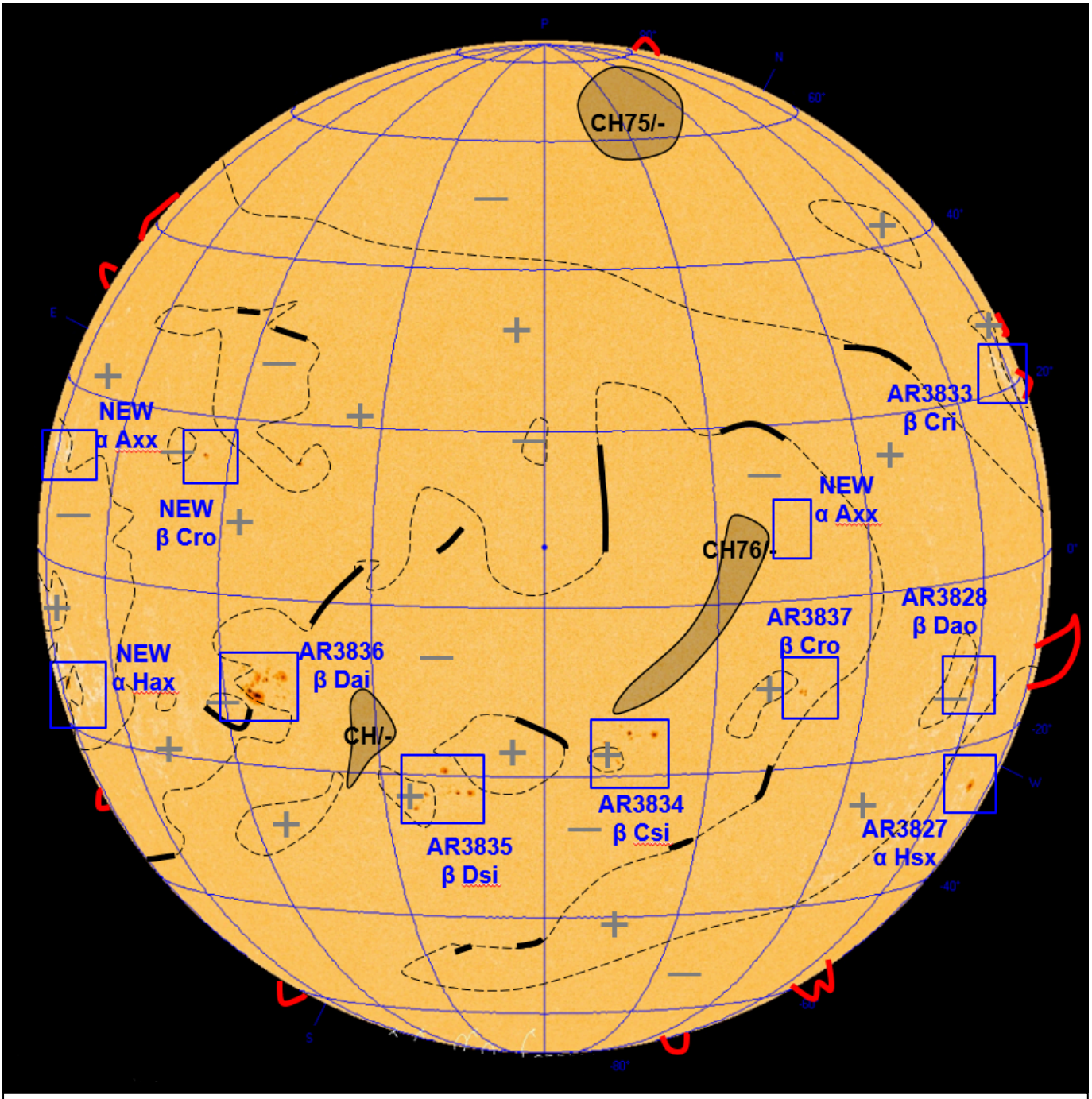
any fast wind onset from CH76/-. However, this is low confidence. Mainly Quiet geomagnetic activity is expected with Unsettled intervals, but with a chance for Unsettled to Active periods from any temporary fast wind enhancement late day 2-3 (28-29 Sep).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is forecast to persist at background. High energy electron flux at GOES16 is likely to remain at Moderate to High levels, with the associated 24 hour Electron Fluence also rising as a response. This will bring a chance of Active fluence, mainly by day 2 (28 Sep), although confidence remains low.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: Synoptic analysis 26/1900 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

The CME from the M3.7 flare off the southeast quadrant has likely either missed.

The current background level winds are expected to persist until a possible weak enhancement occurs, from CH76/-, a coronal hole in the western hemisphere. As a negative polarity feature, this is unfavoured for a strong connection at Earth so close to the autumnal equinox. As the feature is so narrow only slightly elevated winds speeds are expected, around 450km/s, with potential onset late tomorrow or more likely during day 3 (28-29 Sep).

Mainly Quiet (Kp 0-2) conditions are expected with isolated Unsettled (Kp 3) intervals initially, and also to end the forecast period. The onset of any fast wind of CH76 will likely bring a spell of Unsettled to Active (Kp 3-4), most likely on days 2-3 (Sep 28-29).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

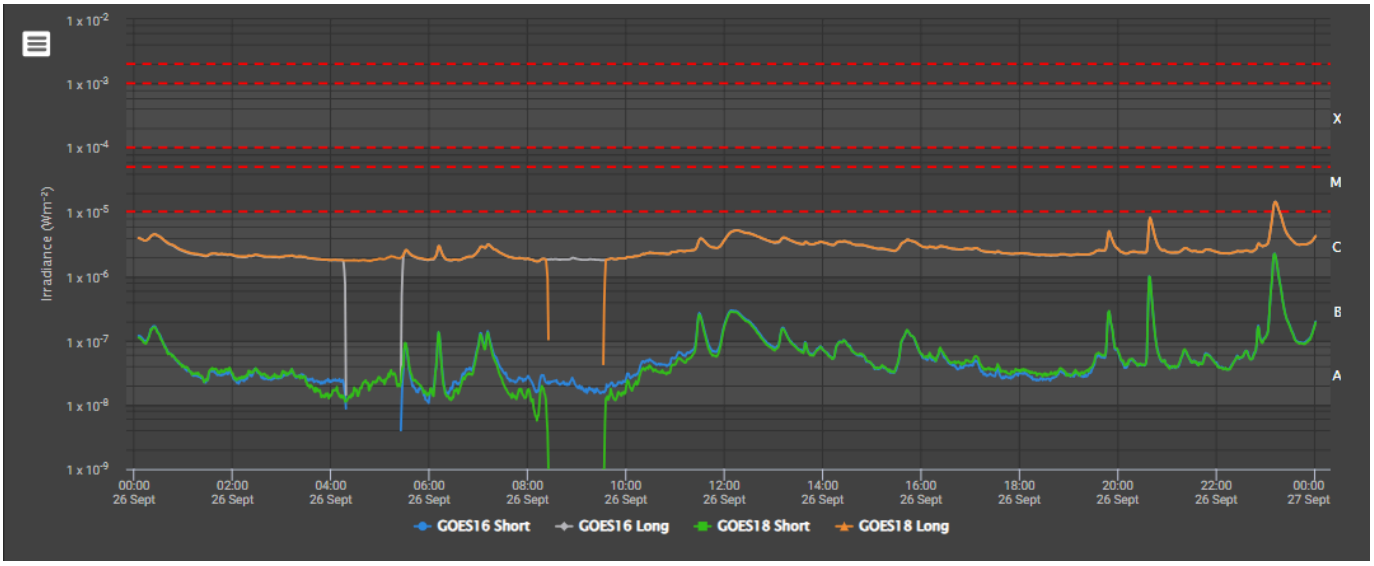
There are currently eleven sunspot regions on the visible disc. The largest of these is AR3836, however the majority of this region is made of one polarity, with only very faint and small trailing positive polarity spots. AR3835 in the southeast and AR3834 in the south centre are perhaps also of note, comprising of a number of small spots, but any development continues to be limited. AR3833 is becoming hard to observe and is also relatively simple. The two new regions moving onto the visible disc from over the east limb remain difficult to assess, with the region on the southeast limb. Further bright flux remains evident on the east limb, which may indicate further regions to rotate onto the disc.

Bright flux continues to be evident on the east limb, e.g. in SDO aia-94, associated with a region which will soon rotate onto the southeast limb. This is supported by far-side helioseismic products, which indicate a strong region of flux over the east limb, although at this stage it is impossible to tell the complexity of any such spot.

Activity was Moderate with one isolated flare peaking at M1.4 at 26/2312 UTC from a new region approaching the southeast limb. Low to Moderate activity is expected with a a chance of further isolated M-class flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

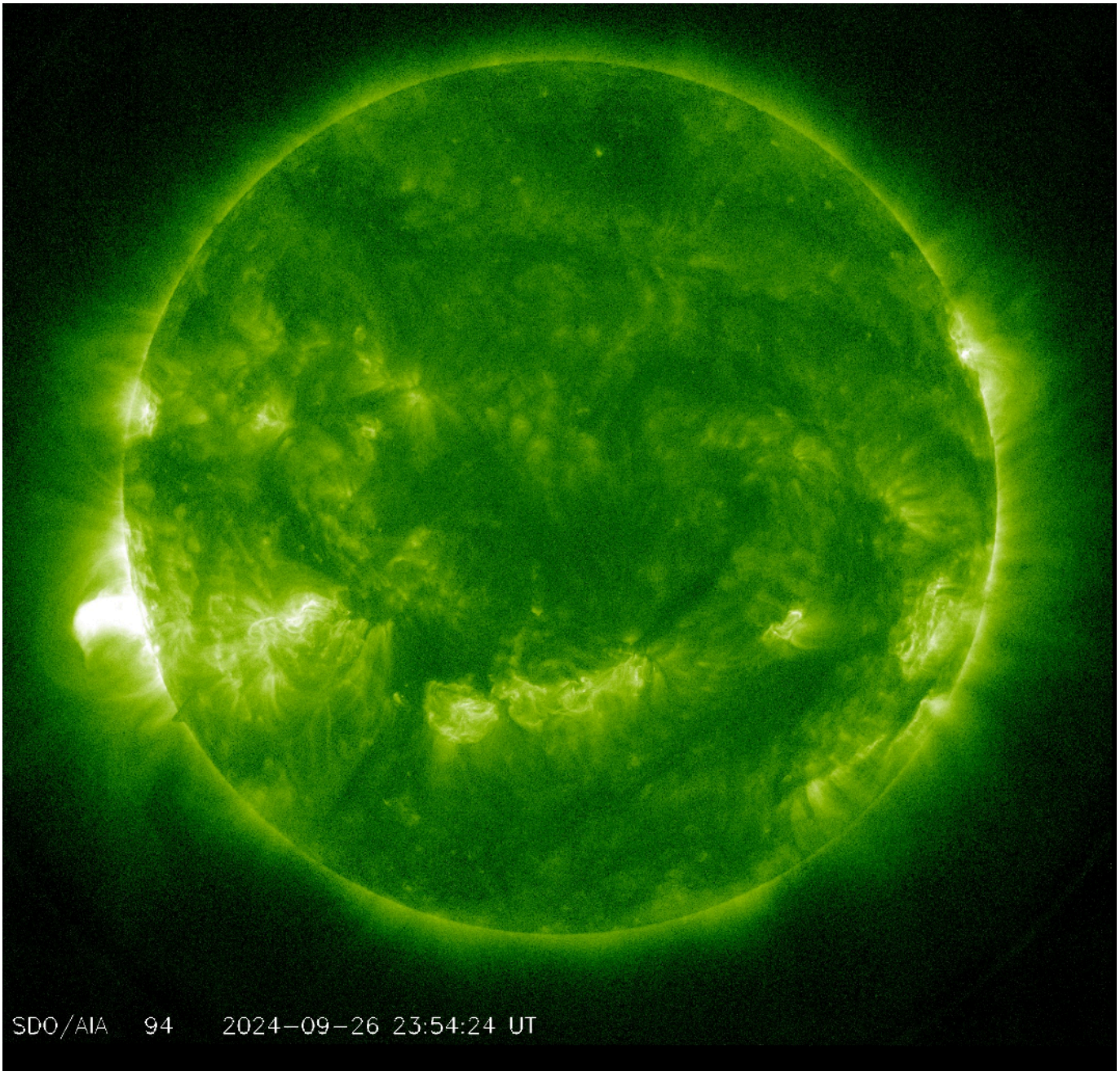
Figure 2: GOES 16/18 x-ray flux for the past 24 hours.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: Latest SDO/AIA 94 image.



© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is forecast to persist at background levels, with only a very slight chance of rising above the S1/Minor Radiation Storm threshold.

The current visible sunspots are small and largely simple providing only modest contributions to flare risk, and any subsequent proton production. However given the number and size of notable filaments currently on the disc, there is also a non-zero, albeit very low chance of observable protons should any significant filament eruption occur.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

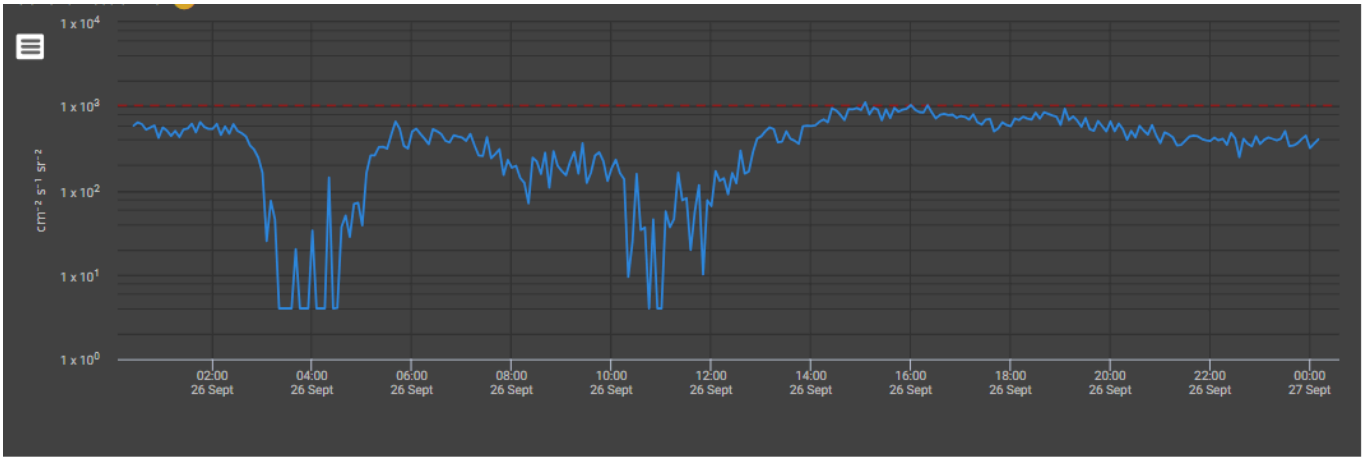
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) observed by GOES16 increased to predominantly Moderate levels over the past 24 hours, briefly reaching High levels. Little change is expected, with generally moderate levels persisting but with occasional peaks to High levels during the peak of the diurnal cycle. Any fast wind enhancement from CH76/- also has the potential to suppress the observed flux days 2-3 (28-29 Sep), however this is low confidence.

The associated 24 hour fluence is currently below the Active threshold, but a continued rising trend gives a chance of fluence levels reaching Active, most likely by tomorrow and day 3 (28-29 Sep). This is supported by REFM, which also shows a rising trend, although this is currently considered to be underestimating likely values. Confidence is Low however, especially by late day 2-3 due to the potential further fast wind onset.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	40	40	40	30
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	0

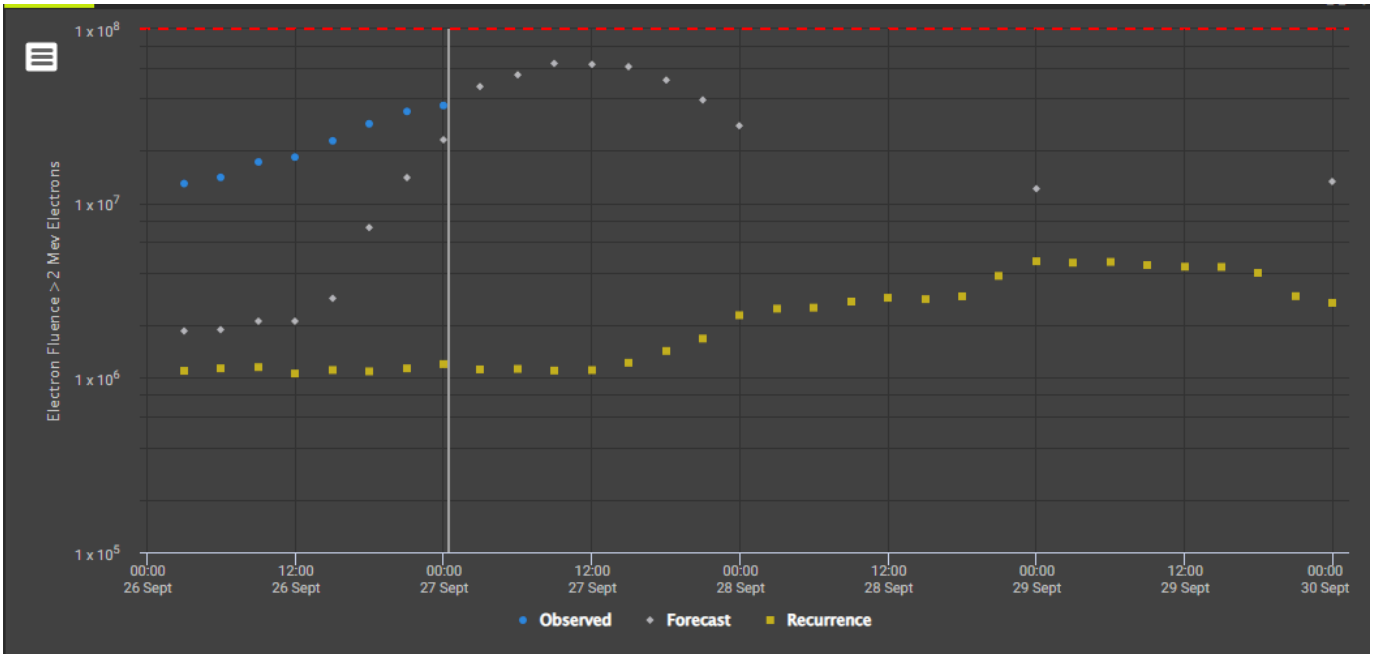
Figure 4: GOES 16 Electron flux for the past 24 hours.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 5: MOSWOC REFM model which is considered to be offering good guidance.



© Crown Copyright 2024. All Rights Reserved.